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The human/wearable technology engagement and its embodied effects on self-trackers

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ABSTRACT

People have for a long time engaged in activities to observe and monitor their physical functions. However, with the modern technological advancements, these practices have turned into a social phenomenon. In Sweden, self-tracking has been given a broad understanding by being introduced as one of several activities of biohacking; an approach of hacking one's body for self-improvement. As people increasingly engage with wearables to alter and improve their bodies, it becomes imperative to investigate the impact of such practices and technologies on experiences. Much of the previous self-tracking literature derives from a governmentality perspective, framing devices as a medium for surveillance and users as subjects to self-regulation. This does not acknowledge the particular agency of the technology and its effects. Although the human/technology relation is well discussed theoretically, in-depth empirical investigations of the self-tracking interrelation are rare, especially from a Swedish context. With an exploratory approach and a material semiotics/embodiment framework, the current study aims to explore and shed light on the interaction between Swedish people committedly involved in self-tracking for improvement and their consistently worn apparatuses, as well as the impact of this interaction on themselves. More specifically: How do self-trackers and devices engage in the human/wearable technology relation and what are the embodied effects on self-trackers? Swedish self-trackers were recruited from interest groups online. 9 in-depth, semi-structured interviews were carried out and subsequently thematically analysed. The paper demonstrates the evolving process of simultaneous, reciprocal agency between individuals and their wearable technologies through three interdependent, chronological stages: the *Precedent stage*, the *Familiarising stage* and the *Engagement – effect stage*. This engagement is a fully embodied experience with behavioural, cognitive, affective, and corporeal impact on individuals' understanding of themselves, their bodies and their technologies. By combining two diverse theoretical fields of subjective and objective bodies, it is shown how an Objective self is internalised into the user's lived body as a heightened *Awareness*. By tentatively introducing the concept of *the Transitional body*, the paper demonstrates how bodies constantly recreate themselves and dynamically transition in-between and across boundaries through negotiation, rather than existing permanently on one side. Thus, this work contributes to the discussion of the intertwined relationship between human and technology in a world where wearables are moving increasingly closer to our skin and beyond.

Keywords: self-tracking, agency, lived body, objective self, transitional body, self-improvement

INTRODUCTION

Monitoring one's physical functions and abilities is not a new phenomenon. Humans have for a long time engaged in practices to observe their bodies to regulate and control it (Lupton, 2016; Neff & Nafus, 2016). Since the introduction of personal weight scales in the end of the 19th century, measuring body weight has been one of the most prevalent techniques of self-monitoring in the world (Crawford, Lingel, & Karppi, 2015). However, with contemporary advancements in technology, the opportunities for what can be done have dramatically increased. Technologies to observe and improve the body have become smaller, smarter, simpler to use, and in turn more widely available to mainstream consumers. As these apparatuses are moving increasingly closer to our skin and flesh (Barfield & Williams, 2017; Park, 2014) they make it possible to scrutinise and alter our bodies, minds and behaviours in ways that has never been imaginable before. This development has created a renewed interest in monitoring the body. Today, such practices are no longer simply something that people do sporadically and casually. Self-tracking has become a social phenomenon. Emphasising "self-knowledge through numbers", the community Quantified Self was founded in California in 2008 to share experiences and learnings between trackers and toolmakers (Wolf, 2010, 2016). This culture has grown largely in only a few years and continue to spread globally (Lupton, 2016). In Sweden, activities of self-tracking have taken a slightly broader approach. The concept was introduced by the organisation BioNyfiken[1] under the term *biohacking* (Ribbing, 2017). Biohacking has been defined as a hacker approach to the human body and biology, a form of self-experimentation for optimisation which includes a range of relating and more or less overlapping undertakings such as bodyhacking, DIY biology and grinding (BioNyfiken, 2017).

As society is becoming extensively interwoven with technology it is imperative to explore how this development is experienced by individuals. When people are increasingly using wearable technology to change and improve their biological bodies, it is important to investigate how such practices in general and technologies in particular effects our everyday understandings as well as the implications of these effects. Much of the previous self-tracking literature draws on a framework of governmentality (Martin, Gutman, & Hutton, 1988). In these studies devices are often construed as a medium for external surveillance through which users become subjects of self-regulation (e.g. French & Smith, 2013; Oxlund, 2012; Ruckenstein, 2014). Consequently, little empirical attention has been paid to the agency from the actual technology and its possible effects. Although the relation between human and technology have been extensively discussed theoretically (e.g. Clark, 2007; Cranny-Francis, 2008; Haraway, 1991; McLuhan, 1994) there is a need for more thorough empirical investigations of self-tracking including the emotional, cognitive and bodily experiences of these practices (Lupton, 2012, 2013a, 2014, 2016; Pantzar & Ruckenstein, 2015; Ruckenstein, 2014; Smith & Vonthethoff, 2017). Moreover, as the majority of studies have been carried out in the United States (Lupton, 2016), examples from a Swedish context are rare.

[1] Literal translation: 'BioCurious'.

Aim and research questions

Deriving from a material semiotics/embodiment framework, the current study aims to explore and shed light on the interaction between Swedish people committedly involved in self-tracking for improvement and their consistently worn apparatuses, as well as the impact of this interaction on themselves. More specifically, it asks:

How do self-trackers and devices engage in the human/wearable technology relation and what are the embodied effects on self-trackers?

As such, the overall purpose of this paper is to contribute with an in-depth empirical perspective to the discussion on the fading contrast between subjective and objective bodies and how we, as humans, constitute ourselves in a world where human and technology are moving closer and closer together.

PREVIOUS RESEARCH

There are a number of articles relating to practices of self-tracking which contributes with valuable knowledge about such experiences. One of these studies is Li, Dey and Forlizzi (2010) who has created a model with five interdependent stages illustrating the process of collecting data for self-reflection. The action in a particular stage is either user-driven, system-driven or both. According to the authors, the process begins even before people start collecting data. This initial phase has been identified as the Preparation stage. For some, there was a specific triggering event that evoked the will to self-track, such as problems with weight and sleep patterns. As several articles have shown, another incentive to start self-tracking is an interest in quantitative data or gadgets and technology. In general, people have been found to approach self-tracking with curiosity about themselves and what can be discovered with the devices (Li et al., 2010; Rooksby, Rost, Morrison, & Chalmers, 2014). However, in the initial period of monitoring, the technology can take some time to get used to. In a study of Ruckenstein (2014), one participant reported that the sensation of the heart rate variability trackers' electrodes against her skin made her feel like a hospital escapee. After some time she became more comfortable with the apparatus and it stopped bothering her.

People who start tracking without specific goals can quickly become engaged as they find intriguing patterns in the data (Choe, Lee, Lee, Pratt, & Kientz, 2014). According to Li et al. (2010), the practices of collecting, uploading/aggregating data, reflection and action occurs separately and consecutively. However, self-tracking and data has been found to induce both actions and emotions in people. Individuals have described an improved health and lifestyle (Choe et al., 2014) by making changes towards a healthier life such as adjusting their working hours to avoid high stress levels revealed in the data. Moreover, self-monitoring activities can generate feelings of proudness - of being active in general (Ruckenstein, 2014) or specifically achieving something, for instance a high bicycle speed or running a marathon. In addition, self-tracking has been related to negative feelings. For some people it connects to issues with body image, aging or breakups

(Rooksby et al., 2014). For others, monitoring emotions can evoke frustration when one becomes aware of unpleasant feelings (Choe et al., 2014).

During the process of tracking, wearables can become daily companions; someone who makes sure the user gets their daily activity in. In the study of Ruckenstein (2014), a number of participants even missed the devices when the tracking phase was over. People who engage in self-monitoring have been found to interpret the data as more trustworthy and factual regarding their everyday lives than their own subjective experience (Ruckenstein, 2014; Smith & Vonthethoff, 2017). As self-trackers communicate about their health and relate to their bodies almost exclusively in numbers, they are "living by numbers", according to Oxlund (2012). As suggested by Smith (2016 in Smith & Vonthethoff, 2017, p. 16); when individuals and their data interplays in a reciprocal relationship they "*become with* one another". An increased closeness between people and their data seem to have been the circumstances for the participants in the research of Ruckenstein (2014) who described a heightened awareness subsequent to wearing an activity watch and a heart rate variability monitor and engaging with its data. They became more attentive to bodily sensations and doings such as eating, drinking and exercising.

The previous literature provides some interesting and important insights about people's experiences of self-tracking and wearable technology-use. However, there are three critical, interconnected concerns: **Firstly**, most of this work has not been restricted to wearable technology exclusively but includes all sorts of tools for collecting personal data such as body weight scales or pen and paper (Choe et al., 2014; Li et al., 2010; Rooksby et al., 2014; Smith & Vonthethoff, 2017). This might obscure insights about the particular experiences of technology engagements. Only the paper of Oxlund (2012) clearly focuses on wearables exclusively in the shape of pedometers. However, pedometers are simpler, earlier types of devices which might not be directly comparable with technologies available for consumers today. **Secondly**, previous research does not focus on the relation between the individual and the technology. In particular, it has not acknowledged the agency from the technology and the effect of this action. Oxlund (2012) and Ruckenstein (2014) draw on a governmentality perspective (Martin et al., 1988). While Oxlund emphasises how the participants relate to moral imperatives of preventive health, Ruckenstein concentrates on how people interact with data exclusively. Neither of these studies focuses on the engagement with the actual physical devices. Similarly, by concentrating on barriers in the user experience, the model of Li et al. excludes the relational aspects of this process. **Thirdly**, albeit these descriptions of self-tracking experiences, most studies do not have a qualitatively thorough approach. For instance, Choe et al. (2014) and Smith and Vonthethoff (2017) analysed videos of recorded Quantified Self Meetup talks available on the official QS website. As such their results are organised around the same structure as the QS Meetup "Show & Tell" talks which focuses on the three questions *What did you do?, How did you do it?*, and *What did you learn?*. This tells us more about the practical knowing rather than the deeper affective and cognitive experiences. In addition, Rooksby et al. (2014) undertook an exploratory approach and carried out unstructured interviews with 22 people with activity trackers or pedometers. The authors were interested in questions such as how and why people

self-track. In this study, the felt experience and people's emotional engagement with tracking was unexpected and not accounted for. Acknowledging self-trackers as individuals who enacts through feelings and bodily sensations would possibly have enriched the work:

> Tracking was explained in terms of people's lives, worries, hopes, interests, careers and so on. Something that we were perhaps a little underprepared for was the emotionality of activity tracking. […] The situation is reminiscent of McCarthy and Wright's discussion of "technology as experience" [13] and we find ourselves drawn to their call for design to engage with *the felt life.* (Rooksby et al., 2014, p. 1171)

The relationship between human and wearable technology has not been extensively explored in the empirics. As numerous scholars have argued; there is a scarceness of thorough qualitative investigations of self-tracking, including the specific meanings attributed to these engagements (Lupton, 2016; Pantzar & Ruckenstein, 2015; Ruckenstein, 2014; Smith & Vonthethoff, 2017). In particular, how the hardware and software used in such practices impacts on emotional, cognitive and bodily experiences (Lupton, 2012, 2013a, 2014). While there are a few representations of self-tracking experiences from Denmark (Oxlund, 2012) and Finland (Ruckenstein, 2014), relating research from Sweden is rare. The present paper intends to address this gap.

THEORETICAL FRAMEWORK

To facilitate the exploration of the engagement in the human/wearable technology relation, this study departs from a material semiotics framework. Theories of the lived body and objective body will be combined to further analyse the embodied effects of this engagement.

Material semiotics

While the classic sociology have concerned humans in relation to institutions and organisations, theories about people and technology connected in networks eventually emerged as a reaction to these universal concepts. Initially, Science and Technology Studies were mostly constituted of case studies of the epistemic undertakings of science. Subsequently, the field expanded to bring in technology through other approaches such as feminism, post-colonialism, semiotics and the history of technology. Drawing on post-humanism and post-structuralism, material semiotics works as an umbrella term for a number of approaches (Law, 2008). Central to these approaches is the emphasis on action and the effectual dimensions of this action on other elements and networks. Agency is not limited to humans in this view. Rather, both people and objects are acknowledged as facilitators of activity. To make this explicit, a clear distinction has been made between the word 'actor' more traditionally associated with action, and the concept of *actant* which emphasises any source of performance – human or non-human (Latour, 1996). Rather than why, this approach makes visible *how* things occur. In what way actants arrange themselves in networks and the attributions produced in these shifts. Rather than looking at the human and non-human as permanent categories, material semiotics understands actants as an effect of relations. In this way, it highlights the reciprocal engagement of this dynamic relation (Law, 2010).

The lived body

According to theorists of the lived body and embodiment, we experience the world through our bodies. This emphasises the physically, mentally and emotionally embodied experiences – our existence – as foundational to self and society (Csordas, 1994). Scholars from fields such as phenomenology, philosophy and STS have theorised that the lived body is something that can be altered, created, and recreated beyond the boundaries of the flesh (Clark, 2007; Cranny-Francis, 2008; Haraway, 1991; Heidegger, 1996; Leder, 1990; McLuhan, 1994; Merleau-Ponty, 2002). In the classic work *Phenomenology of Perception* from 1945, Merleau-Ponty (2002) uses the example of a blind man with a cane to demonstrate how an external object can become bodily incorporated. Central to Merleau-Ponty's discussion is body schema; the practical awareness of the physical and its spatial being. It includes our sensory-motor functionality which enable movement. The body schema makes the interaction between bodily parts and their movement in space seamless. Using his cane repetitively, the blind man learns how to move with it, how to orient himself in the space he occupies. Successively, he will not need to pay attention to his movements or to the cane. As the cane withdraws from his reflective awareness it becomes transparent to the consciousness and the attention transcends to the action (Heidegger, 1996). In this process, his sensory-motor repertoire gradually adjusts to the cane which in turn transforms his body schema. At this point the cane is no longer perceived as simply a physical extension of the arm but has become incorporated into his lived body. As such, the man now experiences the world *through* the cane. The sensory-motor repertoire will continuously shift as new skills and abilities are acquired. The lived body is thus an ongoing, organic process in constant transformation (Leder, 1990).

The discussion of the boundary between body and object as permeable has been developed further parallel to the evolving role of technology in society. One of the earlier connections between human and technology was made in 1964, through Marshall McLuhan's (1994) account of media technology as an extension of the human body and perception. Some decades later, Donna Haraway (1991) introduced the cyborg as a human/technology assemblage. According to her, "A cyborg is a cybernetic organism, a hybrid of machine and organism, a creature of social reality as well as a creature of fiction" (ibid., p. 149). The human/technology assembly have furthermore been described as a dynamic relationship, a *negotiation* through *bodily engagement*. This emphasises the active and creative role of the individual as a "profoundly embodied agent" (Clark, 2007, p. 28) who engages with the technologies through their senses, intellect and emotions. It is this sophisticatedly complex engagement that makes the incorporation of the technology possible (Cranny-Francis, 2008). Further emphasising the individual capacity to make and shape oneself, Barfield and Williams (2017, p. 1) define cyborgism "as a particular way of life, or set of beliefs, which expresses certain meanings in the context of cyborg technologies". Technological metaphors are also commonly applied in discourses on self-tracking (Lupton, 2013b). For example, Swan (2012, 2013) discusses self-monitoring technologies as 'exosenses' which extends the biological senses by producing self-knowledge.

The objective body

In contrast, scholars studying medical technology have argued that the general understanding of the body has transcended from something that can be felt to something which can be seen (Cartwright, 1995; Duden, 1993; Waldby, 2000). External aids such as ultrasound techniques and medical imaging like MRI, CT and PET scans produce interpretations of the body and presents them visually; in numbers, charts and images. These interpretations are often presented as representations through which 'objective facts' the body can be discovered (Dumit, 2004, 2010). Medical anthropologist Joseph Dumit coined the concept *Objective self* to describe "our taken-for-granted notions, theories, and tendencies regarding human bodies, brains, and kinds considered as objective, referential, extrinsic, and objects of science and medicine" (Dumit, 2004, p. 7). Objective selves are of authoritative nature. As they carry a sense of truth status they additionally hold a persuasive power. Dumit uses the term *Objective self-fashioning* to explain "how we take facts about ourselves – about our bodies, minds, capacities, traits, states, limitations, propensities, etc. – that we have read, heard, or otherwise encountered in the world, and *incorporate* them into our lives" (Dumit, 2010, p. 367). Thus, Objective self-fashioning emphasises a double-sided action. Objects produce a pervasive interpretation of people which is perceived as a representation and consequently integrated into people's own understanding of themselves. However, Dumit stresses that this is a fluid and constantly changing process. As people receive new information they fashion and refashion their Objective selves (Dumit, 2004, 2010).

METHODOLOGY

As in-depth, embodied experiences of the human/wearable technology relation are a more or less under-discovered field an exploratory qualitative, abductive approach was undertaken. Material semiotics and theories of embodiment was combined into an overall framework as these perspectives offers a focus on how people and things relate (Law, 2010) and on the physical and mental experiences of these engagements (Cranny-Francis, 2008; Csordas, 1994). As such, material semiotics will be used to understand technology and humans as equally capable of producing and reciprocally being influenced by action. The objective body-perspective was added during the analysis process to reflect antagonistic themes identified in the material. By contrasting the lived body as the felt, subjective experience and the objective body as a 'factual' interpretation of the physical, these diverse perspectives will be combined to illuminate and problematize the subject/object boundary.

The project was designed as an interview study to gain a thoroughly in-depth understanding of experiences of self-tracking and engagement with wearable technology. Collecting material online was considered initially as there are multiple forums, groups and blogs relating to self-tracking. However, in a Swedish context specifically, online accounts of self-tracking experiences are uncommon. Additionally, it was assumed that face-to-face interaction would generate more in-depth data on the matter. Participant observation in self-tracking meetings was seen as an alternative approach. This method might have contributed with rich de-

scriptions of the practices and lessons learned from self-tracking as these meetings are structured around sharing what you do, how you do it and what you learn (Wolf, 2016), such practical reports would likely contain less of in-depth, embodied accounts.

The four ethical requisites by the Swedish Research Council (Vetenskapsrådet, 2002) of information, consent, confidentiality and single usage of data was adopted as an open-ended approach throughout the research process. As such, these points have been considered continuously in all elements of this work. Lived experiences relating to self-tracking practices may touch upon sensitive matters and evoke reactions. However, no ethical concerns or sensitive situations were encountered during the planning, data collecting, analysing or writing of this paper.

Cases and sampling

Participants were selected based on five criteria: **Firstly**, the study was restricted to include Swedish people as the particular focus of this paper is Swedish experiences of self-tracking. A Swedish person was defined as an individual with Swedish citizenship. **Secondly**, participants had to be of at least 18 years of age. Not only are young people sensitive as an ethically challenging group. Including children and teenagers would indeed be methodologically problematic as it would be difficult to distinguish any embodied effects of technology engagement from a natural cognitive and physical developmental process. **Thirdly**, as committed self-trackers for improvement, participants had to be wearing any form of wearable technology consistently and daily in, on or close to their bodies with the purpose of improving mentally and/or physically. Individuals who own self-tracking devices but only use them sporadically were not included as these people would be lacking in experience of engaging with technology. **Fourthly**, as committed self-trackers, the participants had to have worn and used their devices as specified in the third criterion for a minimum of 2 months. A longer period of usage was desired as this implicates more experience. The time limit was set based on the author's personal test of wearing and getting experience of an activity band for the specific purpose of approaching the phenomena in question. **Fifthly**, the tracking had to be voluntarily and self-initiated. In compliance with this criterion, individuals whose self-tracking is initiated and mandated by their health practitioner were excluded as well as tracking performed on individuals by others such as governmental organisations and authorities alike. This limitation was set in consideration of the ethical requisites (Vetenskapsrådet, 2002). In addition, it was assumed that involuntary tracking would impact negatively on people's agency and make them less likely to engage with the technology which in turn would impair the compatibility with the theoretical framework and lessen the coherence with aim and research question.

Although many people in Sweden use or have used an activity band, concepts such as self-tracking and wearable technology are still unknown to many (Ribbing, 2017). To reach people matching the selection criteria, it was decided that participants would be recruited from interest groups through the internet. By making the choice to recruit interviewees from self-tracking crowds, it was acknowl-

edged that the groups' special interest on the topic would likely make the material more or less skewed in relation to a more socially common viewpoint. However, it was additionally recognised that such experiences can contribute with rich descriptions as people interested in self-tracking would assumably be more devoted to aforementioned practices and in turn have more to say about it.

Eight Swedish groups were located that relates to self-tracking practices: *The QS Gothenburg* Meetup group, *Bionyfiken – Biohackers in Göteborg* Meetup group, *Gothenburg Biohacking Community* Facebook group, *The QS Stockholm* Meetup group, *Bionyfiken – Biohackers in Stockholm* Meetup group, *Stockholm Hardware* Meetup group and *QS Stockholm* Facebook group. The organisers of each group were contacted personally. The project was presented briefly with a request for suggestions on how to get in touch with active self-trackers. Through this, five replies granted permission to post in five groups. A shorter letter of invite with information including implications for participants was sent out to all of the members of the Meetup groups QS Gothenburg (154), QS Stockholm (564) and Stockholm Hardware (1464). The same message was posted in the QS Stockholm Facebook group (160 members) and on the Bionyfiken Facebook page (979 followers). Out of a handful replies only one who was interested in participating matched the selection criteria. On the QS Stockholm Facebook group, 3 people had "liked" the invite posted. As the general response rate was low, these people were contacted with a personal message and subsequently recruited to the study as they fitted the selection criteria. Four participants were added through snowballing following personal contact with the group organisers. To test the quality of the interview-guide, recording milieu and diverse unknown factors, one person was recruited from the author's personal network in the role of a pilot interviewee. As the data from this interview came to contribute greatly to the analysis, it was included as P1. Prior to the interviews, all of the nine participants received an extensive, written informed consent letter about the study of which practical and ethical implications they accepted. Table 1 displays an overview of the participants and their wearables. Most of them had used their technologies for two or three years' time but usage ranged from four months to eleven years between devices and between individuals. Participants reside in Gothenburg (4), Stockholm (2), and smaller towns in the area of Götaland (3). Place of residency and profession is not specified further as anonymity for some participants could not be guaranteed if this information was displayed.

Table 1: Participant overview.

P	Age	Sex	Area of profession	Self-tracking technologies worn daily and consistently
P1	49	M	Automotive development	Activity watch, mobile phone: app for food intake
P2	34	M	Design and research	Activity band, smart watch, mobile phone: multiple apps
P3	27	M	IT	Smart watch, mobile phone: task management app and others
P4	41	F	Design and research	Smart watch temporarily exchanged for activity band, mobile phone: apps for sleep, menstrual cycle and others
P5	42	F	Unknown	Activity band, mobile phone: apps for sleep, menstrual cycle, and food intake
P6	39	M	Digital communication	Smart watch, NFC chip implant, mobile phone: multiple apps
P7	50	M	Digital development	Activity watch, two activity bands, smart watch, wearable ring, broche for posture improvement, pedometer, mobile phone: apps for step count, location and others
P8	33	F	Biophysics	Activity band, mobile phone: multiple apps
P9	50	F	Communication	Smart watch, RFID chip implant, mobile phone: mindfulness app

Data collection

To reflect the aim and theoretical framework, a semi-structured interview guide was created building on three themes relating to reciprocal agency (Law, 2008, 2010) and embodied experiences (Csordas, 1994) of self-tracking and wearable technology. The guide was organised with an increasing depth in the themes and inquiries. Starting with a basic, demographic background and overview of the participant's devices, the second theme focused on the practical use and interaction with the particular technologies. This included, for instance, inquires to demonstrate how the devices work and in what way the users and their technologies engage on a typical day. The third and final theme went deeper with questions centring around the physical, cognitive and emotional experiences of this interaction. This theme was readjusted subsequent to the pilot interview with additionally explicit questions in relation to the possible embodied effects of agency. For example: *If you think back on the beginning when you first started using your device, how was it?* and *Compared to then, how is it now*? With an exploratory focus, the majority of the inquiries in the interview guide were deliberately broad and open to catch and subsequently develop any interesting points appearing in the stories of the participants.

In-depth interviews were carried out in February 2017 in Gothenburg, Stockholm and surrounding areas, at the participants' work places, Gothenburg University or in cafés, depending on the preference of the participant. One of the interviews was undertaken in the person's home. To obtain rich and relevant data, the author/interviewer strived to distribute substantial room to the individual narratives while simultaneously leading the way through the questions. While acknowledging both the user and the technology as actants (Latour, 1996), the author was observant of action in multiple directions of this relation, yet, with particular focus on the bodily engagement (Cranny-Francis, 2008) and embodied effects (Csordas, 1994). However, during the interviews it quickly became clear that while the participants were highly talkative about the practical aspects of self-tracking and wearable technology-interaction, it was difficult to reach the deeper, emotional experiences of these doings. The structure of increasing depth in the questions and themes of the interview guide turned out to be a significant support to grasp these more complex and obscure experiences. Therefore, the tentative inquiries were followed in the specific order of the guide, notwithstanding a flexibility to develop intriguing comments relating to other themes than the one currently discussed. Sometimes a wordy elaboration was needed to explain certain phenomena. For instance, many participants misinterpreted the question "*What would it be like if you stopped using your technologies?*" as an inquiry about a temporary pause from tracking rather than a permanent stop. In this case, the actual meaning of the question often had to be both clarified and contextualised by rephrasing it in relation to the narrative in the participants' answers. In total, the interviews lasted in-between one hour to two hours and twenty minutes and were sound recorded and transcribed. During the transcription any information that could be associated with a particular participant such as personal names and specific locations was deleted.

Coding and analysing

Subsequently, the material was coded thematically in NVivo computer software. The theoretical approach, aim and research questions were continuously present in the operational process of coding and analysing. As such, two keywords throughout this phase was *action* (Law, 2008, 2010) and *embodied effects* (Csordas, 1994). More practically articulated: What kind of action occurs in the data and what are the embodied effects? The codes where organised into categories and sub-categories of shared meaning. The analysis was approached with flexibility, moving constantly between codes, categories and entire material. A category was considered an established theme when comparison between the full material, the categories and the codes did not add or eliminate any elements in that specific category. With a total of 511 codes, the analysis resulted in 3 themes and 5 sub-themes.

ANALYSIS

As the result of the analysis, this section will demonstrate the reciprocal engagement between user and technology in a process of three interdependent, chronological stages: The *Precedent stage*, the *Familiarising stage* and the *Engagement - effect stage*. Consisting of both *Instantaneous effects* and *Continuous effects*, the

latter and final stage will be presented in greater detail. In particular, the continuous embodied effects of the technology on the users self, body and understanding of their devices will be elaborated through *Awareness*, *The Transitional body* and *Negotiable boundaries*.

Precedent stage

The *Precedent stage* occurs prior to the actual tracking and physical acquiring of the device. It begins when a decision is made to start tracking, either in general or with a particular device of interest, yet before the technology is in the hands of the individual. In accordance with the Preparation stage identified by Li et al. (2010), the participants' desire to start self-tracking was often evoked by a specific event. The triggers were commonly health related such as recovering from stress or burnout (P2, P9), living with a neuropsychiatric condition (P3, P8) or never having cared about exercising before and being challenged by friends and family to run a 12 km race (P1). For P7, the trigger was someone else's successful experience of self-monitoring in an e-health project at work. In the quote below he describes how the value of self-tracking was revealed to him through a client who had used it to greatly improve her health:

> After three months she had gone from three what she called "feel good hours" to ten. And then someone said: "Yes, that's good" – No, it's completely fucking revolutionary! Because if you have three hours that you feel good in a day or if you have ten – it's an incredible difference in quality of life for a human being. So it was a total eye-opener for me in this project. The significance it has. (P7)

Similar to Li et al. (2010), many respondents express an interest in technology as a reason for tracking (P1, P2, P3, P7, P9). However, an interest in the human body is just as common; nearly half of the participants mention an enthusiasm for the physical (P4, P5, P6, P8). A body focus has been connected to self-tracking practices before but in somewhat negative sentiments of issues with body image and aging (Rooksby et al., 2014). Despite this, people have been found to approach self-tracking with a sense of curiosity (Li et al., 2010; Rooksby et al., 2014). For the participants, the triggering event combined with a body/technology interest leads to a curiosity "to find out what [the device] is and what kind of data and information it can give" (P7). The following quote by P1 illustrates how the decision to participate in the race combined with his technology interest evoked a curiosity that attracted him to purchase an activity watch:

> When I had decided to participate [in the race] I went down [to the shop] and then I saw that they had heart rate monitors. I thought "A heart rate monitor sounds good, then one can see how high one's pulse is when running" […] And I have always liked technology, so that was another thing, it was a gadget to get of course. (P1)

The Precedent stage demonstrates that an emotional attachment to the device begins already prior to the actual acquiring of the technology. A triggering event combined with a body/technology interest evokes a curiosity for what tracking and wearables can give, which in turn interplays in a subsequent decision of purchase.

Familiarising stage

The positive feelings linger with as the individual acquires the device in question and becomes a user. In the *Familiarising stage*, the curiosity is granted further space to thrive as the user explores the specific functions of the technology and acquaint with its characteristics. This activity and stage of experimenting to grow accustomed to the device is not articulated in previous literature. P2 defines it like this:

> When you start using it it's also like, "How well does it work?" and "how well does it match?" So then you have a phase when you test a little. […] [You are] a little curious! "What do I get out of it?" and "what can I track, what can I *not* track?" (P2)

Earlier work has shown that when people start to interact intriguingly with their devices they quickly become devoted to self-tracking (Choe et al., 2014). At the same time, this material reveals that the new apparatus is often experienced as unnatural and unfamiliar. Devices can be physically uncomfortable to wear which makes one more conscious of their presence on the body (IP6, IP9). However, similar to the one respondent of Ruckenstein's (2014) who felt like a hospital escapee, most of the individuals found this unfamiliarity more cognitive-emotional than physical. Many described an initial discrepancy between their idea of the new devices and their understanding of themselves. For instance, P5 recalls purchasing jewellery especially for the purpose of concealing her new activity tracker as she could not identify with what it represented:

> I had to buy new jewellery when I started using it because I didn't want it to show as much. […] You can really see that it's a tracker and I haven't wanted that to be shown. Because, first of all I think it's ugly. And secondly, I think it signals that you are a sporty, super perky type and I'm not. (P5)

In similar manner, P4 received her Apple watch as a gift and felt that it was important to point this fact out to others in her work environment where this particular brand is related to a certain type of personality. Moreover, in the following quote, P4 shares how she had to change her natural voice to sound more robotic when she first started to interact with the watch through voice command. In this way, P4 navigates through her new relationship with the technology by experimenting with various behaviours and reciprocally receiving responses from the watch:

> Yeah, so at that time it was about this with creating a relationship with [the smart watch]. […] I had to talk like a robot to be able to do it at all: "Phone Johan!" [speaks into the watch with a robotic voice] - like that, and then it rang. (P4)

As this initial phase of usage demonstrates, self-trackers begin to build a relationship with their technologies by curiously engaging in exploring and experimenting with their new devices. Doing so, they are physically, cognitively and emotionally aware of its presence as something new and unfamiliar.

Engagement – effect stage

Subsequently, the exploration of the device starts to transcend into a less curious and more mundane state which is ongoing as the individual and the technology continue to engage. While Li et al. (2010) identified four separate stages of Collection, Integration (synthesising and aggregating data), Reflection and Action, these operations were found to be more reflexive than fixed as they occur concurrently and not consecutively for the participants. As such, this phase is defined as the *Engagement – effect stage*. Li et al. (2010) argues that the dominating action of a specific stage can either be user-driven or system-driven or both. In contrast, the Engagement - effect stage is characterised by simultaneous, reciprocal interaction through agency from both user and technology. P2 describes it like this: ”I’m involved in shaping [the technology] at the same time as the technology is involved in shaping me”. In what way the user and the technology engage as interacting actants, as well as how this engagement affects the individual has not been thoroughly explored in previous research. This will be demonstrated hereinafter.

The technology uses mediums such as sounds, messages, graphs and vibrations to appeal to the user by their senses. P7 explains how this becomes a reason for engagement: “It is a form of notification – [the devices] vibrate […] if something happens. So it’s sort of a physical call for attention that makes me and them interact”. By telling the individual what is going on inside of their body, the device produces stories about its user (Smith & Vonthethoff, 2017). In concurrence with previous research (Ruckenstein, 2014; Smith & Vonthethoff, 2017), the participants perceive these interpretations as more trustworthy than their own, subjective experience. As P6 argues:

> It’s a fantastic tool […] Because the experience is always subjective and never particularly close to the truth. A session might feel very heavy and be very ineffective. […] Our experience lies to us, really. Or yeah, they are subjective without any kind of anchoring in correlation to the objectivity. (P6)

In the above quote, P6 constructs wearable technologies as truthful and physical perceptions as deluding. Along the same lines, P3 argues that his aggregated data provides personal knowledge that he otherwise would only falsely assume he possesses. By contrasting *seeing* the aggregated data to *believing*, he displays the significance of his shift from biological sensation to digital information:

> I can really see how I have spent my time. […]. It’s extremely clear when you see it in the app. *Much* clearer, you don’t *believe* it will be as clear because you think you have an okay control […] But you don’t, you’re only fooling yourself to that. But when you gather the data you get it… Yes, it’s a *major* difference indeed. (P3)

Thus, for the participants, that which can be naturally felt is perceived as a sensory illusion and reality is only obtained through what can be seen. This illustrates how quantified representations exert a pervasive power over its users. In the quote below we can see how such Objective selves (Dumit, 2004, 2010) becomes internalised. According to P1, his activity watch displays his true bodily capacity compared to his cognitive perception. Having never exercised before, he states that

observing the improving numbers produced through his activity watch was imperative for his change to become a runner:

> One thing that I have learnt is that what the brain tells you about how tired you are and what the body really endures is not at all the same thing, those are two totally different things. And the watch shows me what the body endures. […] In the beginning, it was awfully tough to run. I probably wouldn't have continued to run had I not been able to see […] Now I could see that bar; 29, 30, 31 - going up, I could see when I improved. (P1)

The quotes from P1, P3 and P6 illustrates that technology undertakes agency through both the real-time numbers displayed in the actual device as well as through the subsequent aggregated data. As the information produced is perceived as more truthful than the subjective experience it is internalised as an Objective self (Dumit, 2004, 2010). The material shows a clear pattern of how this impacts on the participants in multiple ways. Firstly, the effect is behavioural, corporeal, cognitive and affective. Secondly, the influence is both *instantaneous* and *continuous*. The analysis will now turn to demonstrate these embodied effects.

Instantaneous effects

When participants receive a particular type of information from their devices, they often respond instantaneously. P4 describes her reaction in the following way: "Either I think 'Now I need to activate myself' or 'Damn, I'm awesome!'". P8 explains; "You change your behaviour depending on what numbers your technology shows to you. So if you […] track and you get numbers that you don't like, then you will change your behaviour". Indeed, the participants in the study of Ruckenstein (2014) made adjustments towards a healthier life based on the data they received. In what way these instantaneous influences discussed here brings about behavioural change can be contextually elaborated with an example from the interview with P1. In the following quote, P1 discusses how he adjusts his running in accordance with his device. As he receives a notification from his activity watch, he adapts his pace:

> The watch vibrates if I run to fast. So it tells me that "You are over now". […] It can happen that you think in the wrong way, basically. If you're thinking of someone at work who you are crossed with the pulse will go up, it's that sensitive. So you really have to hold the pulse down so that you are in the right zone, sort to speak. (P1)

P1 uses emotional control to change his behaviour to comply with his apparatus. Feelings are central in the engagement with wearables. Previous research has found that self-tracking can evoke both negative (Choe et al., 2014) and positive emotions (Rooksby et al., 2014; Ruckenstein, 2014). This is further evident in the present material. However, the analysis additionally reveals that engaging with wearable technology can be an emotionally ambiguous experience. For instance, P9 displays an affective ambivalence towards getting interrupted by her smart watch. It causes a great deal of annoyance but at the same time the technology becomes a determinant for change when she acknowledges the flaws of human nature which prevents her to mobilise naturally. In the interview excerpt below we can see how the Objective self is fluid rather than permanent (Dumit, 2004, 2010) as P9 engages in a refashioning between her subjective and objective self:

> P9: I didn't want anyone to tell me when to activate myself! [laughs] […] Actually, I just want to tell it [the smart watch] to fuck off. […] If I get to choose then everything must start from *me*.
> Interviewer: Okay, so you prefer that you are the one who starts it?
> P9: Yes, *but*, then I don't always do it. Because I'm a human and no robot. […] I *know* I need to be active. But I don't do it. So I need the help. It's really important!

Thus, the individual is not a passive recipient to impact from the technology, but rather an active actant (Latour, 1996), an embodied negotiator (Clark, 2007) who engages physically, intellectually and emotionally with the device. As this subsection has shown, the interaction between the user and its device has multiplex instantaneous effects. When people receive information from the device's display or graphical output, they use bodily engagement (Cranny-Francis, 2008) to negotiate their behavioural, cognitive and affective response and simultaneously the relationship to their technologies. Below, the final part of the analysis will demonstrate the continuous effects of this relation and how it is negotiated by the individuals.

Continuous effects

As the instantaneous behavioural effects become accumulated into a routine or habit they become *continuous*. All of the respondents expresses that their lives are more or less different since they started self-tracking. As in the research of Choe et al. (2014), many feel healthier and have a more healthful lifestyle. P2 describes how the reciprocal, daily engagement between him and his wearables has impacted positively on his continuous routines:

> I use the technology to shape my everyday life. […] The technological opportunities shape what options I have as well in some ways […] It has influenced me to the degree that I don't ride the bus to work any longer but I get off two stops earlier. (P2)

The quote illustrates the significant role played by the technology and its data in this transformation. Similarly, P5 states that she uses the information from her device to organise her everyday activities. The insight she has obtained through her activity band has changed her for the better: "I use this knowledge to plan activities in my life. […] It's like I'm good…better now" (P5).

Awareness

Thus, the continuous effects of the engagement with technology are not merely behavioural. Rather, the impact extends to an exceedingly profound level. As touched upon by P5 above, it is a certain knowledge obtained through the technology which influences on one's understanding of oneself. The deep consequences of this knowing are elaborated by P3 below. Having been diagnosed with ADD he was searching for methods to increase focus. He started to record all of his everyday tasks to get an idea of how much time he allocates to leisure, work, and school. Although he also monitors physical parameters such as steps, pulse and sleep, it's the task tracking that has made the most difference; it has given him an increased consciousness:

> Interviewer: So how are *you* different since you started with this?
> P3: Wow, I'm very different. [pause] I don't know how to summarise something like that. […] But I have a considerably better consciousness of myself now. Like, previously…you want to […] believe that you have some sort of idea of who you are. […] You don't have any factual ground to believe what you believe. But now I'm like… If I say I am good at something, then I'm pretty sure that I'm good at that.

Above, P3 additionally exposes that when one's subjective experiences are mediated through the device they become trustworthy. This is further evident in the following statements by P8 and P5. Their quotes highlight how seeing information about one's physical state in turn makes one more attentive to what is happening on the inside. Thus, this obtained knowledge operates both directly and indirectly on the participants. P8 explains it as follows:

> In the same way that I have a heart rate monitor or track my brain waves – it's more that I can *see* what is happening inside of my body, I can *see* with my own eyes. It's like it's not concealed but I get to *know* – "Okay, but how is it?" sort of. […] I guess it's more attentive. I think that's what one becomes. One becomes more *aware*. […] Sort of, "how do I really feel?". More, like, you look inwards. (P8)

Hence, *seeing* leads to *knowing* through which "one becomes more *aware*". Similarly, P5 describes how observing the information on her activity band makes her more "concentrated attentive" of her active body but that she additionally acquires this sense of awareness simply by carrying the device on her body:

> It makes me aware of that…yeah, but sort of like, "I'm almost up to ten thousand steps and if I take the stairs instead of the elevator I will reach that". […] Both that *and* just the fact that I have a Fitbit on me makes me aware of my activity. I mean, not by looking at it, but simply by wearing it […] I become more concentrated attentive to what it is that my body needs and what makes me feel healthy. (P5)

As worded above, *Awareness* occurs when a piece of quantified information from the technology is connected to a certain behaviour and/or a physical sensation. Awareness is a sense of knowing of what is going on inside of the body, through direct or aggregated feedback from the technology and through a heightened attentiveness to corporeal signals. When the subjective experience is mediated through the device, it becomes credible.

The Transitional body

As the heightened Awareness enhances the emphasis on the physical, the body is understood in a new light. P9 is experiencing this as an ongoing shift from perceiving herself as a head without a body to becoming increasingly mindful of the fullness of her physique:

> I am becoming more and more aware of that I have a body, that I'm not just a head. I'm drawn to becoming one of those head footers that children draws [laughs]. And then I want to be more active in my body. And be a *whole* human. It's *that point* I want to reach – a whole, active human. Not just a head. (P9)

Much like P9, P7's body focus was concentrated to the top. He describes how his anatomy used to be something so uncomfortable and unfamiliar that he avoided acknowledging everything from the neck down. However, measuring and tracking its functions has made him able to recognise his full body:

> Before it's been like, "That on the inside, that is just a big black hole of blood" […] The body is a stand for the brain. […] A little uncomfortable. But sort of something very odd. And *that* has changed. From something which I could hardly even say *the word* – my *own body* […] It makes the understanding of the body move a little towards being more okay. It's not an odd thing. (P7)

Thus, bodies can transition both physically as well as cognitively and emotionally. This is further articulated by P8 in an empowering sentiment. For her, tracking her biology has become a means to change it. Initially believing that the bodily state one is born with is permanent, she now creates herself, day by day:

> It feels more and more like I sort of create myself. […] I choose who I want to be. For a very long time I believed that one is a bit of a victim of one's own biology. That one is a victim of one's own genes. (P8)

The above quotes together illustrate that engagement in self-tracking has made the participants aware of their bodies and selves as transformable; as subjects of alteration and recreation. Likewise - although in a slightly different direction - the new possibilities offered by modern technology have also considerably affected P6's understanding of himself and his physique. While previously having a mainstream view of his body, he now perceives it as a tool, much like a mobile phone that can be upgraded, maintained and improved to eliminate the full deterioration of death:

> I usually talk about my own body as a cyborg. […] The body is no sort of holy temple in that way but a tool like anything else. And in the same way that I upgrade my phone every now and then it is fantastic to be able to upgrade one's body. […] Thanks to that I started with technology, it has perhaps rather opened up new possibilities which I hadn't thought of previously or that used to be very sci-fi but is reality today. […] If you would have asked me when I was 25 how I see aging I would have had a more mainstream idea. Today I'm not entirely sure I will die of age. (P6)

In this way, P6 is actively and gradually transforming himself from biological to technological. Thus, as a certain lifestyle and worldview (Barfield & Williams, 2017), the making of the cyborg body is only limited by ones imagination (Haraway, 1991).

Negotiable boundaries

Seeing himself as a cyborg, P6 makes little distinction between his upgraded body and technology. In this way, he has accepted his NFC chip implant and Apple Watch as integrated parts of himself. In contrast, the other participants clearly differentiate their biological bodies and their devices. As P9 argues: "I'm me – a human. And the technology is technology. […] It's not a part of me – *the human* [name]. It is a part that the human [name] uses". Discussing this divergence, the participants use a mechanical terminology to define their apparatuses. The technology is a crutch for knowing (P8), a tool (P4, P9) for self-improvement (P3, P8) and to feel better (P5). Yet, at other times the devices are defined in a softer, more soulful wording. P5 expresses a meaningful alliance of dependency, one from which she acquires something truly essential: "They are my best friend because they produce so much data! […] the technologies become sort of…yes, but really my best friend". As previously argued, tracking-devices can become daily companions (Ruckenstein, 2014). To P9, the smart watch is her "little helper". Along

the same lines, P2 contemplates: ”What have they become now? […] It’s rather easy to ask the armband and the bar charts compared to oneself. […] Someone who has a little control, sort of like a coach”. Similarly, P1 argues: ”It’s like a colleague. […] It judges you all the time really and tells you how you did. That you have with you all the time”. Although of judging character, this colleague is not merely with P1 physically but also cognitively and emotionally. An attachment which he is reluctant to part from:

> I am very fond of my watch. I think it is very good. […] I have had it for three years now – it is a rechargeable battery in it – so I am supposed to hand it in but I…then I have to be without it for a week…so I leave it for a while longer. (P1)

Some of the respondents of Ruckenstein’s (2014) missed the devices when the tracking phase in the study was over and they were unable to continue tracking. Indeed, most of the participants in the current study are averse to the idea of voluntarily stop wearing their devices and quit monitoring themselves. In fact, many struggle to even relate to the idea of *n*ot tracking. As P4 argues: ”No, that is such a hypothetical question so it’s difficult to answer [laughs]”. Two respondents imagined it would be like “going back in time” (P6) and “going back in self-development” (P8). Speculating further, P7 portrays a distressing, cognitive and emotional loss of control:

> I think I would perceive it as something unfamiliar. That it was an unknown factor in my life. […] Especially since I have been tracking so much, the small, but yet feeling of control would disappear. It’s sort of like: “Oh! But now…oh! Okay. Now one is left on one’s own here”. It wouldn’t be very pleasant. (P7)

In the above quote, P7 emphasises that he is now familiar with his devices to the degree that *not* engaging with them would be an odd experience. Indeed, many respondents express that their wearables have become natural (P1, P4, P5, P6, P7, P9) – a part of their everyday life (P6, P8). They are used to wearing their devices (P2, P4) and they think little about them (P3, P6, P7) unless they take them off (P1, P6, P4, P5). Below, P4 discusses how she is sacrificing her beloved accessories to wear the less flattering activity band as the mere thought of missing out on data is loaded with so much negativity:

> P4: I was *always,* always wearing a watch before. I have a lot of watches. Many different, sort of like accessories. […] It’s a bit of a sorrow, because I would never wear a watch *as well*. But then sometimes I’ve thought; “Should I take it off to put on a watch?” [Makes frightened face] But what if I miss any important data?!
> Interviewer: You don’t want to take it off?
> P4: No, then it has to be sort of like a standpoint, sort of like “Now I take it off”.
> Interviewer: So compared to then, are your feelings the same or have they changed?
> P4: No, I guess they have changed in that it is so natural now.

The interview excerpt demonstrates how P4 is used to the sensation of wearing the smart watch on her wrist. However, the familiarity is not simply about a physical feeling. More importantly, it is the Awareness – the feeling of knowing what is going on inside of the body – that has become natural. In fact, most of the respondents claim that the actual device is exchangeable. For instance, P3 can see

the benefits of swapping his smart watch for a pill as long as it would provide him with accurate data:

> It's just something that sits there, lights up my skin a little. […] If I would be able to swallow a pill every morning and […] it turns out that the pill is cheap, simple and provides thorough information – then I would give up the watch for it. Then I would get a watch that you don't need to charge every day. (P3)

As P9 points out : "The actual technology is the packaging of the knowledge. Because it's the knowledge that is important". P4 concurs: "It's the awareness, no doubt". Similar to what P7 hypothesised above about voluntarily stop wearing his devices, she too connects such an event to control-loss. She explains that the Awareness has given her an internal peace of mind which she would feel naked without:

> It's probably more an inner satisfaction to know how active I have been. I would have felt very naked without that. Like, "how much have I moved today?!" [Shakes her head and shrugs] To not *know*! (P4)

The connection between the situation of not tracking and an emotional control-loss which results in a perceived nakedness is made by several of the participants. For instance, P1 argues: "It feels…naked to go without really. To not know how active one has been". Discussing the same phenomena, P6 articulates a synonymous link. The loss of bodily information leads him to feel naked:

> I would feel a little naked. Like I was missing information about my body. […] As soon as I don't have my Apple watch on me, then I feel naked, yes. It has become such a big part of my everyday life. And of me, in extension. (P6)

As the participants argue, the actual loss of the technology is additionally a cognitive loss of Awareness which is connected to an emotional loss of control and bodily loss; a sensation of nakedness. Thus, losing one's device creates a fully embodied reaction in the individual. To P6, these points are an illustration of how the smart watch has become integrated parts of him. While most of the other participants have an equally embodied relation to their devices they do not make the same connection. The relation and boundary between the individual and wearable technology will be further discussed below.

DISCUSSION

The engagement between individuals and their wearable technologies is an evolving process with simultaneous and reciprocal agency from both user and technology. This has been demonstrated through three interdependent, chronological stages: The *Precedent stage*, the *Familiarising stage* and the *Engagement – effect stage*. This engagement is a fully embodied experience with behavioural, corporeal, cognitive and affective impact on individuals' understanding of themselves, their bodies and their technologies, *instantaneously* as well as *continuously*.

While initially perceived as more or less unfamiliar, the devices gradually becomes natural to the respondents, something of which they think little about, something that is just 'there'. From a Merleau-Ponty (2002) perspective; the tech-

nologies have receded from their direct attention. When the device become transparent to their consciousness (Heidegger, 1996) they continue on with their daily activities. Only if the individuals would part from the device, they would recognise its non-presence on the body. Smith (2016, in Smith & Vonthethoff, 2017, p. 16) has suggested that individuals and their data can "*become with* one another". When people trust a certain technology it becomes integrated into one's everyday life, understanding of self and body. The more intense feelings invested in this bond, the bigger the chances of incorporation (Lupton, 1995). Indeed, to voluntarily stop self-tracking and quit wearing technologies for this purpose was described as a physically, cognitively and emotionally entangled loss. Oxlund (2012) claims that when people are "living by numbers" the data objectifies them which has an effect on how they inhabit their bodies. Like for the man with the cane, continuously interacting with these devices physically, emotionally and cognitively has gradually reorganised the users' body schemas (Merleau-Ponty, 2002). Thus, this bodily engagement has facilitated an incorporation (Cranny-Francis, 2008) of the Objective self (Dumit, 2004, 2010) into the lived body. This phenomenon is expressed as a heightened *Awareness* - a sense of knowing what is going on inside the body through instant or aggregated feedback from the device and through a heightened attentiveness to bodily sensations. Mediated through the device, subjective sensations become credible. As such, the objective body refashions the lived body of which it is also a part of. Although a higher consciousness of physical activities such as drinking, eating and exercising has been noted in earlier work (Ruckenstein, 2014), the phenomena apparent in the current study goes beyond such bodily doings to reach farther than the surficial. The effects of wearable technology is thus more than an 'exosense', an extension of the biological senses (Swan, 2012, 2013). It is a multi-connected Awareness, deeply entangled with cognitive, physical and emotional experiences of bodily boundaries.

Although the participants emphasise the indispensability of their heightened Awareness, the majority of them frame the device itself as exchangeable while simultaneously making a clear distinction between themselves and their technologies. Hence, bodies do not simply *become* objectified. Rather, people use what makes them human; their intellectual, physical and emotional abilities to constantly negotiate the expansive dimensions of the objective body in the lived, experienced body. In this ongoing act of engagement, the participants simultaneously negotiate their relation to technology (Clark, 2007) and in turn their position to the subjective/objective boundary. Consequently, such a body can be understood as a *Transitional body*. Characterised by agency, the Transitional body is dynamic and plastic - it does not exist permanently on either side of a boundary; rather, it transitions in-between and across, creating and recreating itself through constant bodily negotiation. When people in society change, institutions, organisations and businesses ought to follow and accommodate for new forms of Transitional bodies with diverse subjective/Objective selves: cyborgs, humans and everyone/-thing in-between. The transitional bodies in the current study recreate themselves between boundaries such as biological and technological, awareness and body, emotional and physical, subject and object, and perhaps for some, even between mortal and immortal.

Conclusions

As people increasingly and extensively engage with wearable technology to change and improve themselves, it becomes imperative to examine how such practices and technologies impacts on our experiences. Much of the literature on self-tracking and wearable technology derives from a perspective of governmentality (Martin et al., 1988) where devices are framed as a medium for surveillance through which users become subjects to self-regulation (e.g. French & Smith, 2013; Oxlund, 2012; Ruckenstein, 2014). Consequently, in what way individuals and their technologies engage and the effect of this engagement has not been thoroughly explored in previous research.

In contrast to former work relating to practices of self-tracking (Choe et al., 2014; Li et al., 2010; Oxlund, 2012; Rooksby et al., 2014; Ruckenstein, 2014; Smith & Vonthethoff, 2017), this study derives from a material semiotics/embodiment framework to demonstrate that the relation between individuals and their wearable technologies is an evolving process with simultaneous and reciprocal agency from both user and technology. This engagement is a fully embodied experience with behavioural, corporeal, cognitive and emotional impact on individuals' understanding of themselves, their bodies and their technologies. By combining the two contrasting theoretical fields of subjective and objective bodies, it shows how an Objective self (Dumit, 2004, 2010) becomes internalised into the users' lived bodies which in turn results in a heightened *Awareness*. However, bodies do not simply *become* objectified. People use what makes them human – their intellectual, affective and physical abilities to negotiate the expansive dimensions of the objective body in the lived body and in turn their relation to technology. By tentatively introducing the concept of *the Transitional body*, the paper highlights how bodies constantly recreate themselves and transition in-between and across these boundaries through bodily negotiation. As such, this work contributes to the discussion of the intertwined relationship between human and technology in a world where technology are moving increasingly closer to our skin and beyond.

However, there are several limitations. The study is exploratory and restricted in size. The participants cannot be claimed to represent any general experiences of self-tracking as they were recruited from specific interest groups. Additional empirical research is required to further expand the knowledge of the human/wearable technology relation, how people move in-between such boundaries and how heterogeneous Transitional bodies might be accommodated for by social institutions, organisations and businesses. Scholars are suggested to explore these topics in a larger group of people, preferably from a mainstream population. In addition, more research on self-tracking experiences within a Swedish and Scandinavian context is required.

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